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Stakeholders' Perceptions on Agricultural Land-Use Change, and Associated Factors, in Nigeria

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Abstract: Agricultural Land-Use Change (ALUC) is a major driver of global environmental change, not least via its direct impact on the sustainability and resilience of the rural economy. Its drivers are complex and have remained contentious, necessitating further empirical study. This study aims to derive context-specific evidence on the driving factors and effects of ALUC from different stakeholders' perceptions. We carried out household surveys and participatory rural appraisal across Benue State, Nigeria. ALUC has economic, social, ecological, and institutional implications for farmers and on agricultural productivity. Farmers perceived that the main factors driving ALUC were land conflict, government land-use policies and infrastructural development. Stakeholders' perceptions revealed that although the factors driving ALUC are diverse in nature, they are somewhat embedded within the broader issue of land-use conflict, which has led to cropland abandonment, clearing of forest vegetation, soil degradation, changes from large scale to subsistence farming, and farmers' eventual loss of interest in agriculture. This suggests that the drivers and implications of ALUC go beyond simple changes to the extent of land used for agriculture, but also incorporates other regional socio-ecological changes. Our study highlights the importance of stakeholders' perceptions in understanding complex socio-ecological issues if we are to provide clear direction into areas where policy interventions are most needed.

Keywords: land-use change; land-use conflict; drivers; crop farmers; cropland abandonment; participatory rural appraisal



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1. Introduction

Agricultural land-use change (ALUC) is one of the major global changes affecting environmental sustainability and agricultural productivity [1]. For example, agricultural expansion is one of the key drivers of deforestation [2] and urban expansion has been implicated in the loss of agricultural lands [3]. ALUC encompasses both the conversion of natural vegetation to agricultural lands and also the reverse process whereby agricultural lands transition to non-agricultural uses [4]. The drivers of this phenomena are complex and have remained contentious [5], necessitating further empirical study. They vary according to local context [6], making it challenging to generalize findings [7]. Some drivers of ALUC such as urban expansion and land degradation can lead solely to a reduction in agricultural land [3,8]. Others, such as population growth and government policies, can drive either expansion or reductions depending on the context where they are in operation [2,9]. Factors such as economic opportunities, poverty, food insecurity, and land tenure, have been found to drive ALUC [10,11].

Given the uncertainty surrounding the drivers and effects of ALUC, it is important to examine it from the perspectives of stakeholders who are subject to any implications, and can drive the change to match their own interests [4]. Stakeholder perception/opinion has always been a critical component of any research that has societal relevance and has

often contributed to shaping policy directions [12]. Indeed, decisions on the final implementation of scientific evidence are not solely based on scientific rationale but have often been influenced by public opinion [13]. Recent experiences with climate science reports have further shown that when scientific evidence engages with the public, opinions and convictions may be more influential in shaping the eventual actions undertaken as a result of the report than the evidence itself [14,15]. This shows that scientific research data are not autonomous entities. In many cases, they may need to be complemented with public opinions to complete a research trajectory. Stakeholder perception in this context represents public opinions regarding the driving factors and effects of ALUC. Stakeholders have been used in various participatory land management decision-making processes [16,17], adaptive management of socio-ecological systems [18], and in understanding how perceptions and actual data coincided [19].

Even though ALUC is a significant issue in sub-Saharan Africa, thus far most studies have solely relied on remote sensing to quantify changes (e.g., [20,21]). Where stakeholder perspectives have been captured (e.g., [22]), perspectives helped in understanding and anticipating future trajectories. It thus proffers solutions that are policy specific to the needs of the affected. Understanding different stakeholders' perspectives of ALUC, and their implications is essential for determining the proximate and underlying causes, identifying the effects, reversing unsustainable land management practices, ensuring fair representation of diverse interests, and ascertaining where policy interventions are most needed.

In Nigeria, the most populous country in Africa, no studies on ALUC have incorporated stakeholder perspectives. Results from remote-sensing based studies (e.g., [23,24]) thus lack inputs of individuals with experiential knowledge. This could possibly mislead policy interventions and may partly explain why land-use studies and policy have not been able to address accelerating ALUC, and the associated implications for the environment, food security, and livelihood sustainability. The recent experience of land-use conflict between Nigerian farmers and nomadic herdsman [25], and the particular socioeconomic characteristics of Nigerian farmers such as gender disparity in access to resources, low levels of income and education, limited livelihood opportunities [26], affect farmer perceptions, and thus assessing these perceptions could provide a richer perspective on the issue of ALUC.

This is especially significant for Benue—an agrarian Nigerian state, where spatio-temporal analyses suggest a trend in the conversion of agricultural lands to non-agricultural purposes [27,28]. For instance, while [27] reported that agricultural lands in Makurdi Benue decreased from 32.6% in 1986 to 7.50% in 2016, [28] found that wetlands for agriculture decreased from 26.3% in 1996 to 18.1% in 2016. However, it is unclear what the underlying driving factors of these changes are and how they affect farmers' productivity. Benue is also one of the states most affected by farmer-herder conflict in Nigeria [29]. This study therefore aimed to (i) investigate different perceptions on ALUC from stakeholders in an agrarian state; (ii) identify the factors driving ALUC, and (iii) ascertain different effects of ALUC on farming practices, farming decisions, and crop yield output from stakeholders' perspective. Our overarching aim is to derive context-specific evidence on ALUC from stakeholders who have background knowledge about the issue in Benue State, Nigeria, Africa.

2. Materials and Methods

2.1. Study Area

Benue state, Nigeria, Africa (Figure 1) is noted as a “food basket” state as it can produce virtually all major food crops of the nation, such as rice (*Oryza sativa*), cassava (*Manihot esculenta*), yam (*Dioscorea* spp.), maize (*Zea mays*), sweet potato (*Lopmoea batata*), groundnut (*Arachis hypogaea*), sorghum (*Sorghum bicolor*), and cowpea (*Vigna unguiculata*) as well as tree crops such as oil palm (*Elaeis guineensis*), orange (*Citrus sinensis*), mango (*Mangifera indica*), and cashew (*Anacardium occidentale*) [30]. We purposely selected the state because agriculture is the major source of livelihood for over 70% of its 4.25 million population [30]. However, the prolonged incidence of farmer-herder conflict has made Benue a

center of resource-based conflict in Nigeria [31]. We wished, therefore, to understand the connection of this conflict in the context of ongoing ALUC.

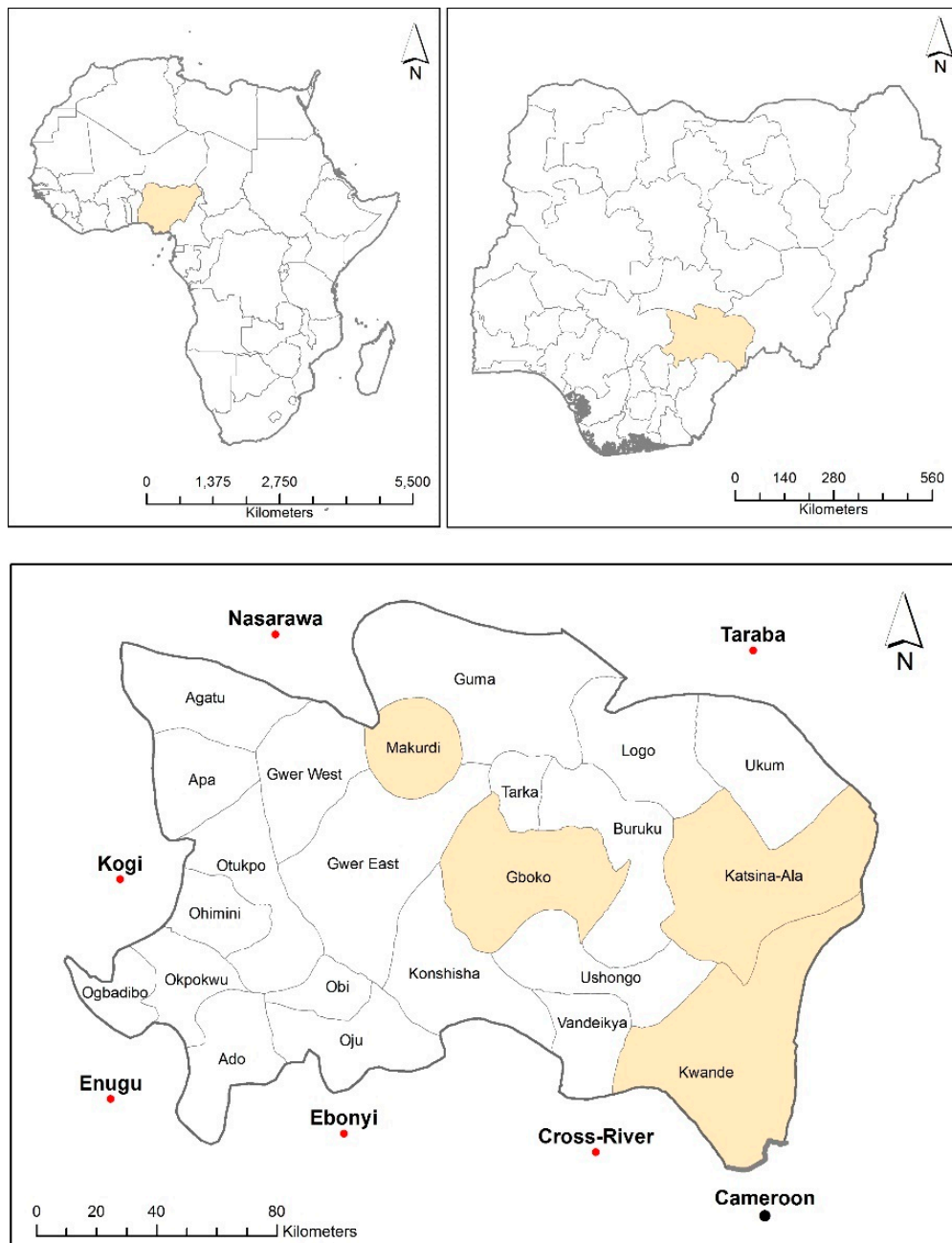


Figure 1. The upper left-hand map shows the location of Nigeria in Africa while the upper right-hand map shows the location of Benue state in Nigeria. Coordinates: longitude $7^{\circ}47'$ and $10^{\circ}0'$ E; Latitude $6^{\circ}25'$ and $8^{\circ}8'$ N. The shaded areas in the map of Benue are the four sampled local government areas (LGAs) situated within the two agricultural zones that constitute the most active farming zones in Benue state. (i.e., Benue north and Benue east zones). The unshaded areas are other LGAs in Benue not included in the study.

Concerning the nature and trend of land-use land-cover changes in Benue state, [32] reported an overall decreasing trend in agricultural lands and natural vegetation and a corresponding increasing trend in built-up areas between 1980 and 2015. The study further revealed a spatial and temporal variation in land-use changes within the state, where the decline in agricultural lands was more rapid in areas of high human settlement

and industrial activities such as Makurdi and Gboko more than in less developed and urbanized rural areas such as Katsina-Ala.

2.2. Methodological Approach

We employed a mixed-method approach, where quantitative data were combined with context-specific qualitative data. We did this using two approaches, a household survey and participatory rural appraisal (PRA). The quantitative data were obtained through questionnaires at the household level which were complemented by an accompanying semi-structured interview. This approach is ideal for gathering diverse opinions on an issue and allows the respondents to answer at their own pace [33]. However, due to the low literacy level in the area, respondents were assisted in reading and explanation of the questions by researchers trained to ensure they did not bias responses. Questionnaires were designed to collect data on demographic and farm variables, as well as data on farmers' perception of ALUC, including factors driving ALUC (See S1 in Supplementary Material). Qualitative information on stakeholders' perception of ALUC, the underlying driving factors and effects were elicited using PRA. PRA is an effective method of collecting information as it allows people to engage in the analysis of a problem affecting their environment and livelihood, and proffering pragmatic solutions and leading to research insights that would otherwise be unlikely to emerge [34]. As a type of qualitative data, PRA provides information about social structures such as internal practices within a particular field, and individual experiences [34]. The objectives of understanding the underlying driving factors and effects of ALUC falls within this scope of analysis, and as such justifies its usage in the study (See S2 in Supplementary Material for PRA question guide).

2.2.1. Household Survey

A multi-stage sampling technique was used to select the farming households that were wholly or predominately farming crops, the main form of agriculture in the state. In stage one, two agricultural zones that constitute the most active farming zones in terms of the quantity of crops produced were purposively selected out of the three zones that made up Benue state [35]. The selected zones are Benue north and Benue east. In stage two, two Local Government Areas (LGAs) were randomly selected from each of the two zones. In stage three, two communities were randomly selected from each of the LGAs (i.e., eight communities), and finally, in stage four, 20 farming household heads who are crop farmers were randomly selected from each community using the list of farmers obtained from the agricultural development office in each LGA. This gave a total sample size of 160 respondents used for the survey. Household heads were used in the survey because according to [36], they stand a better chance of representing the living condition of the entire household. We, however, recognize that one of the limitations of surveying only household heads is the possibility of missing out on the perspectives of women. This notwithstanding, our study involved a good mix of male and female participants, especially in the Participatory Rural Appraisal (PRA).

2.2.2. Participatory Rural Appraisal

Participatory rural appraisal (PRA) was conducted in each of the eight communities where the household survey was conducted and at the Benue State Ministry of Lands and Survey, for a period of 30 days. Proportional random sampling was used to select PRA participants in each community. According to [34], PRA participants and sample size should be determined by the nature of the problem being studied, and the knowledge and expertise of people needed to provide holistic information about the problem. We identified four stakeholder groups relevant to ALUC in Benue state, and they include farmers, forest dwellers, urban planners (land-use experts), and community leaders. Farmers are stakeholders because they manage agricultural lands, and therefore have direct experience of agricultural land-use change. Similar to the farmers are the forest dwellers whose sources of livelihoods, directly and indirectly, depends on the forests which are also being affected

by land-use changes. Urban planners are experts in the area of urban and community land-use planning. They will thus have a more informed and broader and professional perspective about the nature of ALUC in the state. They can also provide key information regarding the role of government land-use policies in addressing the issue of ALUC. Community leaders have a positionality advantage in understanding cultural nuances, and discerning community politics [37]. They will therefore provide information on the occurrence of ALUC across their community, as well as the role of traditional norms and institutions in resolving ALUC issues.

From each of the eight communities, three farmers (two male and a female), three forest dwellers (two female and a male), and two community leaders (a male and a female) were selected to give a total of eight PRA participants per community. All the participants at the community level had a good knowledge of the community's agricultural history. Expert opinions were drawn from two urban planners (a male and female) at the Benue State Ministry of Lands and Survey. This brings the total number of PRA participants in this study to 66. The age of all the PRA participants ranged from 38 to 79 years. To avoid gender interferences, reduce power dynamics, and ensure freedom of expression during the PRA meetings, participants were divided according to stakeholder groups, and meetings were held in different sessions; first with the farmers, second with the forest dwellers, third with the community leaders, and finally with the urban planning experts at the Benue State Ministry of Lands and Survey. This gave a total number of four PRA teams in the study. A question guide (see S2 in Supplementary Material) was developed for each stakeholder group and was used to elicit responses on stakeholders' perception of ALUC, factors driving ALUC, effects of ALUC on farming/forestry practices, farming/livelihood decisions, and farm productivity, and finally the role of traditional leadership or government in ALUC. The PRA tools used during interaction with the community people included a transect walk, direct observations, and semi-structured interviews. Semi-structured interview and participant observation were used during discussion with the land-use experts. All the PRA meetings were tape recorded and notes were taken during the discussions. Each PRA meeting lasted for about 40 to 60 min. PRA activities were run by three facilitators consisting of EJI and two assistants who were natives of the study area. All the group discussions with the community members were conducted in the local language while discussion with the experts was conducted in English.

We acknowledge the exclusion of the cattle herders as one of the stakeholder groups for this study. The herders are important considering their role in the ongoing ALUC in Benue state. Their perspective was, however, not captured in this study due to the security risk involved in accessing them. As at the period of data collection for this study, there were violent incidents involving the herders and the farmers, with the former reported to be armed. In the absence of armed violence or with adequate security measures for the researcher, their inclusion in further studies is recommended to ensure inclusive representation of stakeholder perspective. However, despite their exclusion, the quality of stakeholders included in this study provided a rich perspective that helped in untangling and understanding the complex socio-ecological issues around ALUC and provides an important steppingstone for future research.

Qualitative data from the PRA were analyzed using abductive and retroductive inferential approaches to content analysis. While abduction allowed us to analyze data that falls outside the initial theoretical premise of drivers of ALUC, retroduction allowed us to identify conditions or circumstances without which ALUC would not occur [38]. In accordance with the process of qualitative content analysis, the recorded PRA meetings were manually transcribed to allow for coding, where emerging themes and patterns in responses were established [39]. Color notation was used to mark and code relevant phrases and sentences in the transcript. To validate our result, the analytical process was iteratively repeated to obtain stable results, which were presented in a manifest table using our research questions as a guide (Bengtsson, 2016). Appropriate verbatim quotes have been used to illustrate the key findings.

Considering that data for this study was collected during the period when farmer-herder crisis was at its peak in the study area, it is possible that the impacts of the crisis may influence the perception of the respondents on ALUC. As noted by [40], one of the possible limitations of perception studies is the potential influence of current occurrences on individual perception. We mitigated against this potential bias by triangulating responses from different stakeholders rather than relying on one source of information.

3. Results

3.1. Household Survey

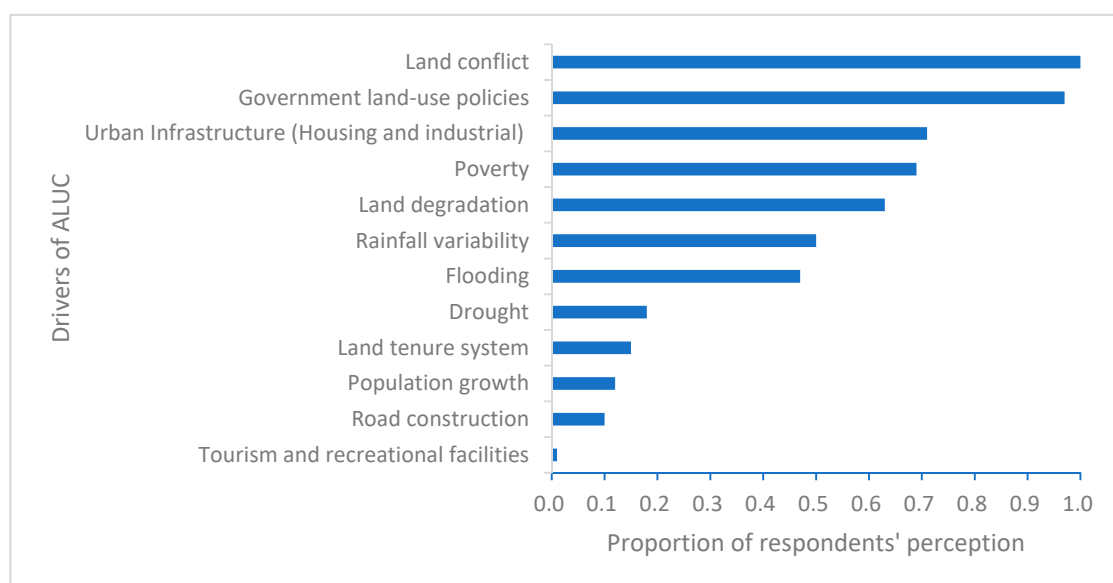
Results from the household survey are presented in Tables 1 and 2 and Figure 2. Out of the 160 farmers who were asked to complete the survey, 157 responded (response rate of 98%). The majority of the crop farmers were male with a mean of 39 years farming experience (Table 1). Mean household size was eight. The majority of crop farmers had only primary education or no education at all. The average farm size was 2.6 Hectares, and mean annual income ₦290,906.25 (\$1040) (Table 1) Private land ownership was the most common tenure system in the area. The majority of crops were arable, although 36 respondents were engaged in mixed farming. In this case, 96 farmers practiced inter-cropping.

Table 1. Result of the household survey showing farmers' demographic and farm characteristics in Benue state, Nigeria (n = 157).

Variables	Mean	Standard Deviation
Age (Years)	60.0	15.0
Number of Adults in household	3.0	1.0
Number of Children household	5.0	3.0
Number of spouses	2.0	1.0
Farming Experience (Years)	39.0	15.5
Farm size (Hectares)	2.6	1.1
Annual farm income (Naira)	₦290,906.25 (\$1040)	33.3
Gender	Frequency	Percentages
Male	149	94.9
Female	08	5.1
Education Level		
Tertiary (1)	16	10.2
Secondary (2)	30	19.1
Primary (3)	58	36.9
No formal education (4)	53	33.8
Land tenure		
Private ownership (1)	104	66.2
Rent (2)	51	32.5
Leased (3)	02	1.3
Communal (4)	00	0.0
Type of Crop		
Arable Crops (1)	86	54.8
Vegetable crops (2)	29	18.5
Mixed (3)	36	22.9
Permanent (4)	06	3.8
Cropping System		
Inter-cropping (1)	96	61.1
Mono-cropping (2)	40	25.5
Rotational cropping (3)	21	13.4

Table 2. Timeframes over which farmers (n = 157) perceived ALUC to have taken place within Benue State, Nigeria.

ALUC Timeframe Perception	Increase (%)	Decrease (%)	Total (%)
Within the last 20 years	0.6	5.1	5.7
Within the last 10 years	3.8	6.4	10.2
Within the last 5 years	3.2	62.4	65.6
Within the last 1 year	1.3	17.2	18.5

**Figure 2.** Factors driving agricultural land-use change perceived by farmers in Benue State, Nigeria.

The majority of the farmers perceived that ALUC occurred in the last five years, and the bulk of this change has been a decrease in the area of agricultural land use (Table 2). Farmers identified 12 underlying factors driving ALUC (Figure 2). All the respondents agreed that land-use conflict is the main factor driving ALUC in Benue State. Other significant factors are government-land use policies such as open grazing policy, urban infrastructure, and poverty resulting from lack of alternative sources of livelihoods.

3.2. Participatory Rural Appraisal

Consistent with the result of the household survey (Table 2), all the participants agreed that Benue farmers have experienced significant changes in their agricultural lands, with declines in the area of agricultural lands mostly occurring in the last five years (Table 3). Perceptions of ALUC (Table 3) showed that land-use conflict between the cattle herders and farmers is central. For instance, almost all the farmers and community leaders pointed out that the issue of land-use conflict has resulted to cropland abandonment, destruction of farm crops, crop failure, and consequent high cost of food in the market due to low productivity and general food scarcity. These suggest economic implications of ALUC. Another economic issue is the lack of alternative sources of livelihoods among the forest dwellers and farmers. The livelihoods of majority of the rural dwellers directly depends on agriculture and forest resources. Such direct dependence on land and forest often leads to unsustainable land-use practices such as land conversion and forest degradation. In other cases, poor farmers are also sometimes forced to sell their agricultural lands to meet up with other non-agricultural needs. They are also constrained by power imbalances, financial exclusion, and social inequality which exists in the current social relations of production, making it difficult for them to retain ownership of agricultural lands. These further confirms how poverty is driving ALUC (Figure 2). A social dimension emanating from the

problem of land-use conflict is the sense of insecurity it has created around the cropland environment, and the danger it portrays to the life of farmer. Another key social dimension of ALUC pointed out by both the farmers, forest dwellers, and experts is the issue of infrastructural development which has taken over many croplands. Experts' perceptions revealed further issues around ALUC such as conversion of forests into croplands, cropland fragmentation, and issues of soil erosion and flooding. All the stakeholders pointed out that government policies and actions across all levels of governance is critical in addressing the problems of ALUC. Analysis of stakeholders' perceptions of ALUC therefore shows that it has economic, social, ecological, and institutional implications on farmers and agricultural productivity (Table 3).

When asked what factors they think are responsible for ALUC they have experienced (Table 4), the farmers, community leaders, and land-use experts identified land-use conflict between the farmers and cattle herders and natural disaster such as flooding as the proximate factors driving ALUC. This corresponds with the result of the household survey (Figure 2) where all the farmers identified land-use conflict as the most important factor driving ALUC. One of the land-use experts particularly identified land-use conflict as a factor reducing the scale of farming from large to small scale. The forest dwellers and the experts also identified infrastructure development, as key factors driving ALUC. On the issue of infrastructural development, although Benue State is an agrarian economic-based state in Nigeria, the state government has been diversifying the economy by attracting non-agricultural investors. Farmers' lands are often the primary target for such investments. The farmers noted that this diversification is leading to ALUC. However, underlying these driving factors are poor government action, lack of or poorly implemented land-use policies such as anti-open grazing policies, and issues of land tenure security.

Different stakeholders identified different effects of ALUC on farming/forestry practices, farming decisions, and crop yield and on the environment (Table 5). One key commonality observed among most farmers is that the transition from large scale farming to subsistence farming tended to follow the loss or abandonment of large croplands. All the farmers that participated in the PRA stated that the loss of cropland to land-use conflict reduced their commercial farming practice to subsistence level. Change in the scale of farming practice is however not the only effect of ALUC on farmers; it is also affecting other farm practices such as soil tilling, and consequently farm productivity. Our participating farmers all farmed crops. They therefore highlighted the negative impacts of cattle herding on soil properties, "These heavy herds of cattle match on the soil, and over time make it too hard to till during cultivation. You know we don't use tractors to farm here; we use our hoes to till the ground, and grazing of these cattle are not only making it difficult for us, but also affects the output of some of our tuber crops such as yam and cassava" (Female farmer from village 2). This has affected their farming decisions to adopt the use of organic fertilizer and shifting cultivation in order to soften the soil.

Among the forest dwellers and community leaders, the common effect of ALUC is the practice of shifting cultivation and agroforestry which has implication on loss of biodiversity. The experts implicitly acknowledged that novel practices are required to mitigate impacts of ALUC, and they recommended changes which the farmers, herders and the government can implement. While intensive farming and farm mechanization were recommended for the farmers as approaches to reduce the amount of land required to produce similar amounts of food, ranching was recommended for the herders to reduce the issue of farmer-herder crisis. Creation of forest reserves and anti-open grazing policy are some of the changes that the government can implement to address the issue of ALUC.

Table 3. Key responses of stakeholders' perceptions on agricultural land-use change within the last five years in Benue State, Nigeria, and their implications (ecological, economic, social, and institutional).

Participants' Group	Key Response(s)	Implications
Farmers	<p>Our croplands are no longer the same. We have experienced various changes in the last 5 years. It is either the land is not suitable for farming because of lack of nutrient, or we abandon the suitable ones for fear of conflict with the cattle herders, or other croplands are taken away from us by the government for development purposes</p> <p>Many of us have abandoned our farms for fear of clashing with the cattle herders. Even when we manage to farm, the cattle destroy them because. Also, when the heavy cattle match on the soil, they harden it, thereby making it hard to till.</p> <p>At the moment I do not have enough land to farm, because I have been forced to sell my farmlands to rich businesspeople who are developing this area. I also sold most of my croplands to raise money to solve some family problems.</p> <p>Most women in this community can no longer go to farm again for fear of either being raped or killed by herders. The worst is that Federal government is supporting them to graze openly without restriction. We are handicapped.</p>	<p>Economic: Cropland abandonment Ecological: Loss of soil nutrient Social: urban development Institutional: Land grabbing by government</p> <p>Economic: Cropland abandonment, and destruction of farm crops Ecological: Altering of soil properties Economic: Power imbalance, sale of agricultural lands for other livelihood sustenance. Social: urban development Economic: Cropland abandonment Social: Insecurity of farmland environment Institutional: Open grazing policy.</p>
Forest dwellers	<p>About 5 years ago, state government cleared this area of forest, because they want to build industriesThe worst is that till now, nothing is happening in those places.</p> <p>It is from this forest that we harvest of our foods. We also harvest and sell timber. As you can see, we have large expanse of forest land here and that is the only thing sustaining us. If an area is cleared up, we move to another area. Our forefathers have been doing this. We don't have money to do other businesses, banks will not loan us money to do other things.</p> <p>This whole area (pointing at built-up areas) used to be a thick forest few years ago. But rich people are buying up the land to build residential houses. We are losing our land because we don't have money. We have lost all the food and materials we used to harvest from the forest</p>	<p>Institutional: Land tenure security and land grabbing. Social: Infrastructural development.</p> <p>Economic: Lack of alternative means of livelihood Ecological: Clearing of new forest areas Social: Social inequality. Economic: Financial exclusion</p> <p>Ecological: Loss of forest areas Economic: Social inequality Economic: Loss of livelihood</p>
Community leaders	<p>Our farmers have deserted their croplands because of fear of violent conflict with the cattle herders. They are now forced to clear up new forest areas to continue farming. We are organize our young men into vigilante groups to guard our farm lands</p> <p>We have lost some croplands due to flooding and soil erosion But we compete for the remaining croplands with the cattle herdsman who are destroying our farm crops, and killing our women when challenged . . . food is now expensive because of these . . .</p>	<p>Economic: Cropland abandonment Ecological: Conversion of forest into croplands Institutional: Role of traditional institutions in ALUC Ecological: Soil erosion and flooding Economic: Destruction of farm crops and high food cost Social: Danger to human life and death.</p>

Table 3. Cont.

Participants' Group	Key Response(s)	Implications
Land-use experts	The issues of land fragmentation and flooding are major causes of agricultural land-use change in Benue because they reduce the area of cropland available to individual farmers. The ongoing farmer-herder crisis is complicating the issue because farmer now farm in small scale due for security reasons. Banning of open grazing may help in resolving this issue Agricultural land use change is happening in both ways. Farmers are clearing up new forest vegetations for farming purposes. But they are also losing their lands due to infrastructural development such as industrial, housing, and road constructions, and also land degradation	Ecological: Cropland fragmentation and natural disaster Social: insecurity of farmland environment Economic: Leads to small scale farming Institutional: Anti-open grazing policy Ecological: Forest conversion and land degradation Social: Infrastructural development Institutional: Land tenure security

Table 4. Proximate and underlying factors driving agricultural land-use change within the last five years in Benue State, Nigeria from different stakeholders' perspectives.

Participants' Group	Key Response(s)	Driving Factors	
		Proximate	Underlying
Farmers	There are so many problems affecting our croplands, but the most challenging one at the moment is this problem with cattle herders . . . The state government is trying to stop them, but I don't know why the federal government has refused to call them to order	Land-use conflict	Lack of harmonious action across different levels of government
	For me, I will say it is hardship. When you don't have enough money, you can't even protect your farm against these cattle herders.	Land-use conflict	Social inequality and Poverty
	Isn't it obvious from all we have been discussing that our immediate problem is cattle herders? But it is the government, especially the federal government that doesn't want to call them to order . . . look at that cement company over the road (pointing at a cement plant), I used to farm on that land about ten years ago. But the company collaborated with the government and took our lands by force because according to them, all lands belong to the government . . .	Land-use conflict Industrial development and land grabbing	Lack of government action at the federal level Land tenure security
Forest dwellers	My problem is that the government does not have plans to protect our forests from being cleared by rich people building houses and industries in the name of development.	-Infrastructural development	Lack of government land-use policies
	I will say it because we don't have alternative source of income, and that is why the forest is our only hope of survival. If we have means to do other businesses, we will leave the forest alone.	Lack of alternative means of livelihood	Social inequality
	They say all land belong to the government, and that is why government can take your land or give it out to rich people to build industries and you can't do anything about it.	Land grabbing	Land tenure security

Table 4. Cont.

Participants' Group	Key Response(s)	Driving Factors	
		Proximate	Underlying
Community leaders	The struggle for land with cattle herders is the most important cause of the problem... Both federal and state governments need to work together to solve this, but they are busy fighting each other.	Land-use conflict	Lack of harmonious action across different levels of government
	Currently the major factor driving ALUC here is cattle rearing by the herdsman. We have called for a peace talk between the herders and the farmers, but it did not solve the problem. The federal government doesn't seem to be supporting the efforts of the state government to address this problem.	Land-use conflict	Lack of harmonious action across different levels of government
	Many people in this community were affected by the last flooding. As if that was not enough, this cattle herder will not allow us farm in peace. But the worst is that government is not taking proactive measures. Why can't they make a law forbidding open grazing?	- Natural disaster (e.g., flooding) - Land-use conflict	Lack of government land use policy such as anti-open grazing policy
Land-use experts	We have lost many croplands in Benue due to land degradation, mostly caused by unsustainable land use practices like overgrazing, and indiscriminate building of infrastructures without adequate planning. Most of our farmers also lost their crops in the last flooding we experienced in this state. It was so bad that they could not even farm the following farming season because the lands were still too damp and cannot support crop. The government has not done enough to mitigate these issues	Overgrazing, flooding, poorly planned infrastructural development	Poor government action
	Poor policy implementation remains our biggest problem. I can authoritatively tell you that we have enough land use policies to protect our farmers from losing their lands. But the problem remains the will to implement it. The farmer-herder crisis which is a major problem in this state can be easily addressed through land-use policies like anti-open grazing policy. Again, infrastructural development is a big challenge and major cause of loss of agricultural lands. The government have not done enough to protect the farmers' land Land is an expensive commodity in Makurdi town because everyone wants to live in the city. So the demand for land is high and as such, the prices have gone up. Most farmers who lack money sell their croplands to whomever that is interested	- Land-use conflict, - Infrastructural development; - High demand for land	Poor policy implementation, Poor government land-use policies; Social inequality

Table 5. Key responses of stakeholder on the effects of agricultural land-use change on farming or forestry practices, farming decisions, farm yield or the environment in Benue State, Nigeria.

Participants' Group	Key Response(s)	Farm/Forest Practices	Effects Farming Decisions	Farm Yield/Environment
Farmers	We used to do communal farming with large expanse of land, but now most people just farm beside their house which is very small for fear of their life . . . When you farm far from your house, you risk the destruction of your farm crops by the herders' cattle.	Change to subsistence farming	Shift from large scale farming to small scale farming	Destruction of farm crops
	I used to be a big-time yam farmer which I export to other states in Nigeria. But in the past 4 to 5 years, I have just been selling within Benue, thereby losing money	Change to subsistence farming	Shift from large to small scale farming	Loss of farm income
	Farming is now more difficult because the soils are harder to till. Hard soils also make the crops perform poorly. It discourages us from farming in large scale. Even though we try to use organic manure to soften the soil, but we just farm just to feed our family	Change to subsistence farming	Use of organic manure	Low crop yield
Forest dwellers	When a particular piece of land is degraded, we move to another fertile land and allow it to regain fertility. We have very large forest that we can clear to plant crops	Shifting cultivation	Clearing up new forest vegetation	Loss of biodiversity
	One of the things we now practice here is to grow crops inside this forest because the dead leaves from the trees fertilize our crops. But we still have to cut some tree anyways	Change to agroforestry		Deforestation
	You must have heard how big Benue yam used to be. Such big yams are now very rare to get because are lands are not fertile again. When a land loses fertility, we just leave the land and move to another place.	Change to Shifting cultivation	Clearing up new forest vegetation	Loss of biodiversity
Community leaders	When peoples' croplands are destroyed, they are left with no options but to clear up new forest lands. But clearing up new forest area is expensive and makes farmers lose money		Clearing and conversion of forests for farming	Loss of farm income
	After the last flooding and erosion, where most of our crops were destroyed, some farmers now prefer to farm under forest trees. You know that these trees reduce erosion and water flow... But there are some crops that don't do well under shades	Change to agroforestry		Reduces productivity

Table 5. Cont.

Participants' Group	Key Response(s)	Farm/Forest Practices	Effects Farming Decisions	Farm Yield/Environment
Expert recommendations				
Land-use experts	<p>I am aware that the government have created forest reserves to protect some forest areas from being encroached by farmers or from being destroyed by developers. One of the things the farmers can do is to embrace intensive farming which requires less land area</p> <p>Government should encourage the nomadic herders to adopt modern ranching while the farmers should adopt mechanized farming with the help of the government to increase productivity.... Anti-open grazing policy is needed to address the farmer-herder crisis</p>	Creation of forest reserves	Change to intensive farming	Anti-open grazing policy is recommended
		Change from nomadic lifestyle to ranching	Embrace farm mechanization	

4. Discussion

By analyzing perceptions of stakeholders, we obtained rich insights into the different dimensions of ALUC and were able to demonstrate that ALUC has social, economic, ecological, and institutional implications for farmers and agricultural productivity. The stakeholders identified land-use conflict, government policies and actions, and urban infrastructural development as top factors driving ALUC. However, land-use conflict stands out as the most critical factor driving ALUC because of its diverse effects; with economic implications (e.g., cropland abandonment, destruction of farmcrops); social implications (e.g., insecurity of farmland environment); ecological implications (e.g., clearing of new forest vegetation, soil degradation); and institutional implications (land tenure security, and poor government policies such as open grazing policy). Land-use conflict also had effects on farming decisions such as triggering loss of interest in farming, and farmers' decision to change from large scale farming system to subsistence farming. This suggests the complex role of land-use conflict in driving socio-ecological changes.

Land-use conflict has been a critical policy relevant issue in developed and developing countries. Our results show that land-use conflict is a prominent factor driving ALUC which has, over the years, resulted in abandonment of croplands by farmers, i.e., a situation where farmers completely desert the use of their croplands due to land-use conflict. [41] pinpointed cropland abandonment as one of the multiple trajectories of agricultural land use conflict. Even though some agricultural land-use studies from Europe and North America have identified shrinking of agricultural labor force, migration, economic opportunities and agro-ecological factors as major drivers of farmland abandonment [42,43], we also found that insecurity of farmland could also trigger cropland abandonment, especially in areas of conflict over land resource control, something also identified in Ghana [44]. As found in this study, land-use conflict between nomadic herdsman and farmers has resulted to cropland destruction, internal displacement of farmers, and cropland abandonment.

Cropland abandonment has, elsewhere, contributed to the expansion of natural forests and secondary forest succession [42]. However, we found that in situations of agricultural land-use conflict, this environmental gain may be quickly eroded by another ecological implication of ALUC, namely clearing of forest vegetation. We found that in response to the abandonment of conflict affected croplands, farmers are forced to clear new forests to continue/maintain their farming activities. Clearing of forest vegetation for agricultural purposes is not a new phenomenon in Sub-Saharan Africa. Several studies have implicated agricultural land-use in the loss of natural forest vegetation [2,23]. While some of these studies linked clearing of forest vegetation by farmers to market and economic pressure to produce more food for the growing population, we found that the pressure to clear forest vegetation by farmers could also be linked to land-use conflict which has driven cropland abandonment. Clearing of forest vegetation is consequently a responsive reaction and a survival strategy to the pressures of land-use conflict.

Furthermore, our study showed that one of the key effects of land-use conflict is farmers' decision to change from large scale farming system to subsistence farming. Subsistence farming is usually associated with low farm output and low farm income [45]. Farmers who fear conflict with cattle herders have felt forced to reduce the scale of their farming operations as a security measure. This, in the long-run triggers loss of interest in farming, which is one of the primary factors driving rural-urban migration resulting to shrinking of the agricultural labor force [43]. These indicate that ALUC is not limited to increase or decrease in agricultural lands, but also involves other socio-economic changes happening within agricultural lands.

In addition to the issue of land-use conflict, stakeholders identified infrastructural development as one of the major factors driving ALUC. Several previous studies have identified urban expansion and industrial development as one of the major global drivers of ALUC [3,8]. Ref. [46] described urban land expansion as an irreversible anthropogenic activity that is not only driving habitat fragmentation but also accelerating loss of agricultural lands. In Nigeria, many remote sensing studies have indicated a continuous increase in

built-up areas at the detriment of agricultural lands [23,24]. Our study corroborated these, with most farmers indicating a downward trend in the area of their farmlands (Figure 2). Our study showed that in a country such as Nigeria characterized by high population growth, the need to build more infrastructure such as houses and roads to accommodate the growing population is high. This is further accompanied by the need to diversify the economy from agriculture, raise more income, and build more industries for employment. Both can result in a loss of cultivable agricultural land.

One critical underlying factor driving ALUC is the issue of land tenure insecurity. In Nigeria, the Land Use Act of 1978 invested the control and management of all lands to the state governors and local governments. The state governors provide the right of occupancy for land users. However, majority of the land in Nigeria, especially agricultural lands, are still unregistered with a proof of right of occupancy [47,48]. Consequently, majority of the farmers still suffer from tenure insecurity. We found that the government seem to be taking advantage of this to disposes farmers of their lands through infrastructural development. Indeed, the majority of the farmers are socially insecure, financially excluded, and lack the financial capacity to secure their croplands or obtain certificate of occupancy for their lands. One way to mitigate the loss of croplands to infrastructural development will be to integrate agricultural lands into urban land-use policies in government development agenda. This will help to protect agricultural lands, especially in urban areas from being lost to urban sprawl.

Good government land-use policies such as an anti-open grazing policy or the creation of forest reserves is critical in mitigating the problem of ALUC. Our study found that lack of, or poorly implemented, land-use policies together with the actions and inactions of government at different levels have contributed to exacerbating the issue of ALUC. For instance, farmers perceive the inactions of the federal government towards the farmer-herder crisis as a subtle form of support for the herders. This was part of the overarching perception that the federal government favors the nomadic cattle-herders above the interests of local farmers, something noted by previous work [49]. Such one-sided approaches to the conflict could escalate, rather than mitigate, the problem [49]. Other options could be to implement an anti-open grazing policy, as similar policies have been successfully used to restore normalcy in various other places where there is conflict over land resources [50]. However, there should be balance and equity in the implementation of such policy so that no group feels marginalized. Similarly, one alternative to nomadic cattle rearing could be the adoption of ranching, which has been successfully used in many other countries [51]. To advance further research in this area, we recommend future studies to engage the cattle herders to obtain their perceptions of the land-use conflict. This will provide a more balanced perspective that may promote peaceful conflict resolution.

5. Conclusions

Analysis of stakeholders' perceptions on ALUC shows that although the driving factors and effects of ALUC are diverse in nature, they are somewhat embedded within the broader issue of land-use conflict. Our study indicates that that most of the key effects of ALUC in Nigeria, Africa such as cropland abandonment, clearing of forest vegetation, change to subsistence farming, and loss of interest in farming has their root in the socio-ecological conflict between farmers and nomadic herders over land resource control. The results of this study provide insightful evidence into the complexities surrounding land-use changes and socio-ecological conflicts. It suggests that ALUC go beyond simple changes to the extent of land used for agriculture, but also incorporates other regional socio-ecological changes from the perspective of stakeholders. This corresponds with the study of [52] who argued that stakeholder perspective can play a critical role in highlighting multiple social and environmental dimensions of environmental issues such as land degradation. Our study highlights the usefulness of stakeholders' perceptions in untangling and understanding complex socio-ecological issues around ALUC, in this case, land-use conflict. This does not only complement scientific estimations on agricultural land-use changes, but

also provides clear direction into areas where policy interventions are most needed. Our findings reveal that urgent policy action is needed to address the land-use conflict between farmers and cattle herders which is negatively affecting agricultural productivity.

Supplementary Materials: The following are available online at <https://www.mdpi.com/article/10.3390/environments8110113/s1>, S1: Household survey questionnaire used to collect data from farmers on demographic and farm variables, perceptions, and factors driving agricultural land-use change in Benue state, Nigeria. S2: Question guide used during the Participatorssy rural appraisal meetings with stakeholders in Benue State, Nigeria.

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